



ELECTRONIC TUBE REFERENCE

18013

Voltage - Pentode electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

PENTODE

Philips professional pentode designed for long-life telephone-equipment service. Its intended role is reliable small-signal amplification in communications installations where extended operating life is more important than consumer-receiver convenience.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	7
NOMINAL HEATER	4 V / 1.3 A	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION1 Pentode	
TRANSCONDUCTANCE	0.005 S
MAXIMUM PLATE VOLTAGE	220 V
MAXIMUM SCREEN VOLTAGE	220 V
MAXIMUM PLATE DISSIPATION	1.8 W
MAXIMUM SCREEN DISSIPATION	0.4 W
MAXIMUM CATHODE CURRENT	12 mA
Indirectly heated Philips pentode for telephone equipment, with published preamplifier and output-stage operating conditions.	

18013 — Telephone Equipment Pentode

Overview

The **18013** is an indirectly heated pentode designed specifically for use in telephone equipment. It is optimized for high-reliability applications, operating either as a pre-amplifier or as a low-power output valve. The tube features a 4 V heater, a metallized shield connection, and a top-cap control grid configuration to minimize input capacitance and coupling.

Construction, Heater, and Physical Dimensions

The 18013 is constructed with an indirectly heated cathode designed for parallel supply using either AC or DC. The physical envelope is characterized by a maximum bulb diameter of 47 mm and a maximum height of 121 mm (excluding the pins). The base pins have a maximum length of 18 mm.

Heater Ratings

- **Heater Voltage (V_f):** 4 V
- **Heater Current (I_f):** 1.3 A
- **Heating Method:** Indirect, parallel supply (AC or DC)

Pinout and Connections

The control grid (g_1) is brought out to a top cap on the envelope to ensure high isolation. The remaining electrodes are connected to the base contacts as follows:

- **Top Cap:** Grid 1 (g_1)
- **Pin 1:** Cathode (k)
- **Pins 2, 3:** Heater (f, f)
- **Pin 4:** Grid 3 (g_3 , suppressor grid)
- **Pin 5:** Anode (a)
- **Pin 8:** Metallization / Shielding (m)
- **Pin 10:** Grid 2 (g_2 , screen grid)

Interelectrode Capacitances

The physical layout of the electrodes, including the top-cap control grid and the internal shielding, results in low feedback capacitance:

- **Anode capacitance (C_a):** 7.5 pF
- **Grid 1 capacitance (C_{g1}):** 9.8 pF
- **Feedback capacitance (C_{ag1}):** < 0.012 pF
- **Grid 1 to heater capacitance (C_{g1f}):** < 0.2 pF

Typical Electrical Characteristics

At a standard operating point, the 18013 exhibits high internal resistance and a transconductance of 5 mA/V. The typical characteristics are measured under the following conditions:

Parameter	Value
Anode Voltage (V_a)	200 V
Grid 3 Voltage (V_{g3})	0 V
Grid 2 Voltage ($V_{[g2]}(/tubes/G2)$)	200 V
Cathode Resistor (R_k)	265 Ω
Anode Current (I_a)	8 mA
Grid 2 Current ($I_{[g2]}(/tubes/G2)$)	1.5 mA
Transconductance (S)	5 mA/V
Screen-to-Control Grid Amplification Factor (μ_{g2g1})	48
Internal Resistance (R_i)	1 M Ω
Equivalent Noise Resistance (H.F.) (R_{eq})	max. 2.5 k Ω
Equivalent Noise Resistance (L.F. / B.F. / N.F.) (R_{eq})	max. 10 k Ω

Operating Conditions

The 18013 is specified for two distinct operating modes in telephone equipment: as a pre-amplifier and as an output valve.

Pre-amplifier Service

When configured as a pre-amplifier, the tube operates with a 20 k Ω anode load resistor. Under these conditions, it provides a voltage gain of 4.5 (also expressed as 4.5 N).

- **Anode Voltage (V_a):** 200 V
- **Grid 3 Voltage (V_{g3}):** 0 V
- **Grid 2 Voltage ($V_{[g2]}(/tubes/G2)$):** 200 V
- **Cathode Resistor (R_k):** 265 Ω
- **Anode Load Resistor (R_a):** 20 k Ω
- **Anode Current (I_a):** 8 mA
- **Grid 2 Current ($I_{[g2]}(/tubes/G2)$):** 1.5 mA

- **Transconductance (S):** 5 mA/V
- **Internal Resistance (R_i):** 1 M Ω
- **Voltage Gain (V_o/V_i):** 4.5 (4.5 N)
- **Maximum Grid 1 Resistor (R_{g1}):**
 - With cathode/automatic bias: 1 M Ω
 - With fixed grid bias: 0.5 M Ω

Output Valve Service

When used as an output stage, the anode load resistor is increased to 30 k Ω . This configuration delivers a modest power output with low distortion.

- **Anode Voltage (V_a):** 200 V
- **Grid 3 Voltage (V_{g3}):** 0 V
- **Grid 2 Voltage ($V_{[g2]}(/tubes/G2)$):** 200 V
- **Cathode Resistor (R_k):** 265 Ω
- **Anode Load Resistor (R_a):** 30 k Ω
- **Anode Current (I_a):** 8 mA
- **Grid 2 Current ($I_{[g2]}(/tubes/G2)$):** 1.5 mA
- **Transconductance (S):** 5 mA/V
- **Internal Resistance (R_i):** 1 M Ω
- **Output Power (W_o):** 0.1 W
- **Total Distortion (d_{tot}):** < 5%
- **Maximum Grid 1 Resistor (R_{g1}):**
 - With cathode/automatic bias: 0.3 M Ω
 - With fixed grid bias: 0.15 M Ω

Limiting Values (Absolute Maxima)

To ensure reliable operation in telephone systems, the following maximum ratings must not be exceeded:

Parameter	Absolute Maximum Value
Cold Anode Voltage (V_{ao})	450 V
Anode Voltage (V_a)	220 V
Anode Dissipation (W_a)	1.8 W
Cold Grid 2 Voltage (V_{g2o})	450 V
Grid 2 Voltage ($V_{[g2]}(/tubes/G2)$)	220 V
Grid 2 Dissipation ($W_{[g2]}(/tubes/G2)$)	0.4 W

Parameter	Absolute Maximum Value
Cathode Current (I_k)	12 mA
Grid 1 Voltage (V_{g1} at $I_{g1} = +0.3 \mu\text{A}$)	-1.3 V
Heater-to-Cathode Voltage (V_{fk})	50 V
Heater-to-Cathode Resistance (R_{fk})	20 k Ω

Technical Summary

The **18013** is a specialized telephone-grade pentode featuring a 4 V, 1.3 A heater, a top-cap control grid, and an integrated metallized shield. It is characterized by a high internal resistance of 1 M Ω and a transconductance of 5 mA/V under typical operating conditions. Designed for dual-role service, it functions effectively as a pre-amplifier (yielding a gain of 4.5 N with a 20 k Ω load) or as a low-power output valve (delivering 0.1 W into a 30 k Ω load with less than 5% total distortion). Strict limiting values, including a maximum anode dissipation of 1.8 W and a maximum cathode current of 12 mA, ensure long-term stability in demanding telecommunication circuits.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1957 Philips Receiving and Amplifying Tubes

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1957 PHILIPS RECEIVING AND AMPLIFYING TUBES

Section 1 · Pentode

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Anode Voltage	200 V	—
Screen Voltage	200 V	—
Anode Current	8 mA	—
Screen Current	1.5 mA	—

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1963 Philips Electron Tubes Handbook V1

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1963 PHILIPS ELECTRON TUBES HANDBOOK V1

Section 1 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	200 V	TelephoneAmplifier
Screen voltage	200 V	TelephoneAmplifier
Cathode resistor	265 ohm	TelephoneAmplifier
Plate current	8 mA	TelephoneAmplifier
Screen current	1.5 mA	TelephoneAmplifier

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Output power	0.1 W	OutputValve

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Transconductance	5000 μ S	—
Plate resistance	1 M Ω m	—

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Anode capacitance	7.5 pF	—
Control-grid capacitance	9.8 pF	—
Anode-to-control-grid capacitance	0.012 pF	Maximum where stated
Control-grid-to-heater capacitance	0.2 pF	Maximum where stated



SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

SOURCE PDF

1999 Philips 0-D

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1999 PHILIPS 0-D
Section 1 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage	4 V	Nominal
Heater current	1.3 A	Nominal
Maximum plate voltage	220 V	Maximum
Maximum screen voltage	220 V	Maximum

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	1000000 Ω m	Typical
Transconductance	5000 μ S	Typical

TUBE TINKER

An independent reference for electronic tubes, vacuum tubes,
and their source documents.

[Catalog](#) [Tube types](#) [Full books](#) [Blog](#) [Feedback & corrections](#)

© 2026 Tube Tinker